

## MC9S12C-Family

### Product Proposal 16-Bit Microcontroller

Based on Motorola's market-leading flash technology, members of the MC9S12C-Family deliver the power and flexibility of our 16 Bit core (CPU12) family to a whole new range of cost and space sensitive, general purpose Industrial and Automotive network applications. MC9S12C-Family members are comprised of standard on-chip peripherals including a 16-bit central processing unit (CPU12), up to 128K bytes of Flash EEPROM or ROM, up to 4K bytes of RAM, an asynchronous serial communications interface (SCI), a serial peripheral interface (SPI), an 8-channel 16-bit timer module (TIM), a 6-channel 8-bit Pulse Width Modulator (PWM), an 8-channel, 10-bit analog-to-digital converter (ADC) and up to one CAN 2.0 A, B software compatible module (MSCAN12). The MC9S12C-Family has full 16-bit data paths throughout. The inclusion of a PLL circuit allows power consumption and performance to be adjusted to suit operational requirements. In addition to the I/O ports available in each module, up to 10 dedicated I/O port bits are available with Wake-Up capability from STOP or WAIT mode. The MC9S12C-Family is available in 48, 52 and 80 pin QFP packages, with the 80 Pin version pin compatible to the HCS12 B and D- Family derivatives.

The C-Family includes ROM versions MC3S12C128/96/64/32/16 of all devices which provide a further cost reduction path for applications with high volume and stable code.

#### Features

- **16-bit HCS12 CORE**
  - HCS12 CPU
  - MMC (memory map and interface)
  - INT (interrupt control)
  - BDM (background debug mode)
  - DBG12 (enhanced debug12 module including breakpoints and change-of-flow trace buffer)
  - Multiplexed Expansion Bus (available only in 80 pin package version)
- **16-bit HCS12 CPU**
  - Upward compatible with M68HC11 instruction set
  - Interrupt stacking and programmer's model identical to M68HC11
  - Instruction queue
  - Enhanced indexed addressing
- **Wake-up interrupt inputs**
  - Up to 10-port bits available for wake up interrupt function
- **Memory options**
  - 16K, 32K, 64K, 96K and 128K Byte Flash EEPROM (erasable in 512-byte sectors) or
  - 16K, 32K, 64K, 96K and 128K Byte ROM
  - 2K and 4K Byte RAM
- **Analog-to-Digital Converters**
  - One 8-channel module with 10-bit resolution.
  - External conversion trigger capability
- **Up to one 1M bit per second, CAN 2.0 A, B software compatible modules**
  - Five receive and three transmit buffers

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- Flexible identifier filter programmable as 2 x 32 bit, 4 x 16 bit or 8 x 8 bit
- Four separate interrupt channels for receive, transmit, error and wake-up
- Low-pass filter wake-up function
- Loop-back for self test operation
- **Timer Module (TIM)**
  - 16-bit Counter with 7-bit Prescaler
  - 8 programmable input capture or output compare channels
  - Simple PWM Mode
  - Modulo Reset of Timer Counter
  - 16-Bit Pulse Accumulator
  - External Event Counting
  - Gated Time Accumulation
- **6 PWM channels**
  - Programmable period and duty cycle
  - 8-bit 6-channel or 16-bit 3-channel
  - Separate control for each pulse width and duty cycle
  - Center-aligned or left-aligned outputs
  - Programmable clock select logic with a wide range of frequencies
  - Fast emergency shutdown input
- **Serial interfaces**
  - One asynchronous serial communications interface (SCI)
  - One synchronous serial peripheral interface (SPI)
- **CRG (Clock Reset Generator Module)**
  - Windowed COP watchdog,
  - Real time interrupt,
  - Clock monitor,
  - Clock generation
  - Reset Generation
  - Phase-locked loop clock frequency multiplier
  - Limp home mode in absence of external clock
  - Low power 0.5 to 16 MHz crystal oscillator reference clock
- **Operation frequency**
  - 32MHz equivalent to 16MHz Bus Speed for single chip
  - 32MHz equivalent to 16MHz Bus Speed in expanded bus modes
  - Option: 50MHz equivalent to 25MHz Bus Speed
- **Internal 2.5V Regulator**
  - Supports an input voltage range from 3.3V-10% to 5.5V
  - Low power mode capability
  - Includes low voltage reset (LVR) circuitry
  - Includes low voltage interrupt (LVI) circuitry
- **48-Pin LQFP, 52-Pin LQFP or 80-Pin QFP package**
  - Up to 58 I/O lines with 5V input and drive capability
  - Up to 2 dedicated 5V input only lines (IRQ, XIRQ)
  - 5V A/D converter inputs and 5V I/O
- **Development support**
  - Single-wire background debug™ mode (BDM)
  - On-chip hardware breakpoints
  - Enhanced DBG12 debug features

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Table 1 List of MC9S12C-Family members

Flash	ROM	RAM	Package	Device	CAN	SCI	SPI	A/D	PWM	Timer	I/O
128K	0	4K	48LQFP	MC9S12C128	1	1	1	8ch	6ch	8ch	31
			52LQFP	MC9S12C128	1	1	1	8ch	6ch	8ch	35
			80QFP	MC9S12C128	1	1	1	8ch	6ch	8ch	60
96K	0	4K	48LQFP	MC9S12C96	1	1	1	8ch	6ch	8ch	31
			52LQFP	MC9S12C96	1	1	1	8ch	6ch	8ch	35
			80QFP	MC9S12C96	1	1	1	8ch	6ch	8ch	60
64K	0	4K	48LQFP	MC9S12C64	1	1	1	8ch	6ch	8ch	31
			52LQFP	MC9S12C64	1	1	1	8ch	6ch	8ch	35
			80QFP	MC9S12C64	1	1	1	8ch	6ch	8ch	60
32K	0	2K	48LQFP	MC9S12C32	1	1	1	8ch	6ch	8ch	31
			52LQFP	MC9S12C32	1	1	1	8ch	6ch	8ch	35
			80QFP	MC9S12C32	1	1	1	8ch	6ch	8ch	60
32K	0	2K	48LQFP	MC9S12GC32	0	1	1	8ch	6ch	8ch	31
			52LQFP	MC9S12GC32	0	1	1	8ch	6ch	8ch	35
16K	0	2K	48LQFP	MC9S12GC16	0	1	1	8ch	6ch	8ch	31
			52LQFP	MC9S12GC16	0	1	1	8ch	6ch	8ch	35
0	128K	4K	48LQFP	MC3S12C128	1	1	1	8ch	6ch	8ch	31
			52LQFP	MC3S12C128	1	1	1	8ch	6ch	8ch	35
			80QFP	MC3S12C128	1	1	1	8ch	6ch	8ch	60
0	96K	4K	48LQFP	MC3S12C96	1	1	1	8ch	6ch	8ch	31
			52LQFP	MC3S12C96	1	1	1	8ch	6ch	8ch	35
			80QFP	MC3S12C96	1	1	1	8ch	6ch	8ch	60
0	64K	4K	48LQFP	MC3S12C64	1	1	1	8ch	6ch	8ch	31
			52LQFP	MC3S12C64	1	1	1	8ch	6ch	8ch	35
			80QFP	MC3S12C64	1	1	1	8ch	6ch	8ch	60
0	32K	2K	48LQFP	MC3S12C32	1	1	1	8ch	6ch	8ch	31
			52LQFP	MC3S12C32	1	1	1	8ch	6ch	8ch	35
			80QFP	MC3S12C32	1	1	1	8ch	6ch	8ch	60
0	32K	2K	48LQFP	MC3S12GC32	0	1	1	8ch	6ch	8ch	31
			52LQFP	MC3S12GC32	0	1	1	8ch	6ch	8ch	35
0	16K	2K	48LQFP	MC9S12GC16	0	1	1	8ch	6ch	8ch	31
			52LQFP	MC9S12GC16	0	1	1	8ch	6ch	8ch	35

• Pin out explanations:

— I/O is the sum of ports capable to act as digital input or output.

For 80 Pin Versions:

Port A = 8, B = 8, E = 6 + 2 input only, J = 2, M = 6, P = 8, S = 4, T = 8, PAD = 8.  
12 inputs provide Interrupt capability (P= 8, J = 2, IRQ, XIRQ)

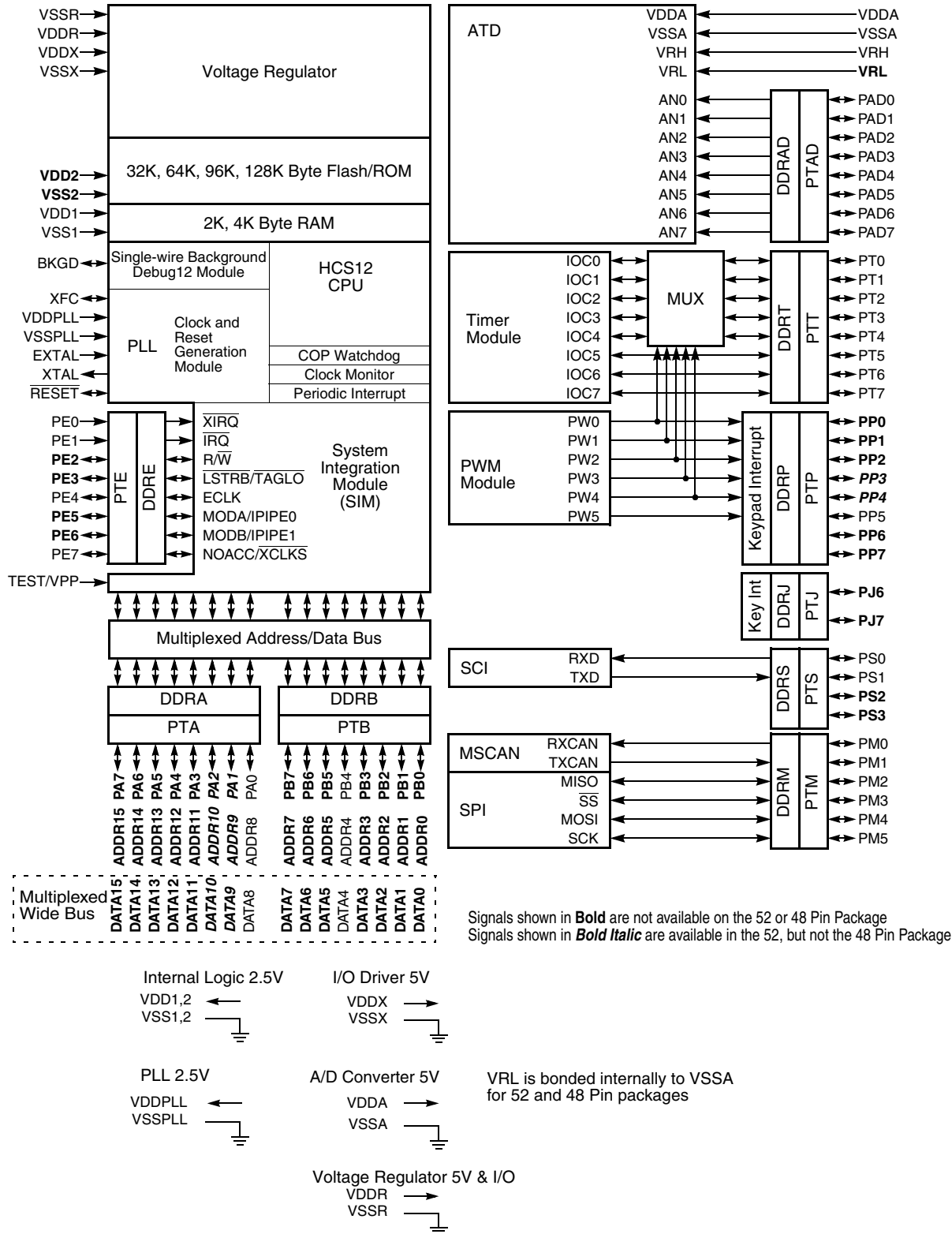
For 52 Pin Versions:

Port A = 3, B = 1, E = 2 + 2 input only, M = 6, P = 3, S = 2, T = 8, PAD = 8.  
5 inputs provide Interrupt capability (P= 3, IRQ, XIRQ)

For 48 Pin Versions:

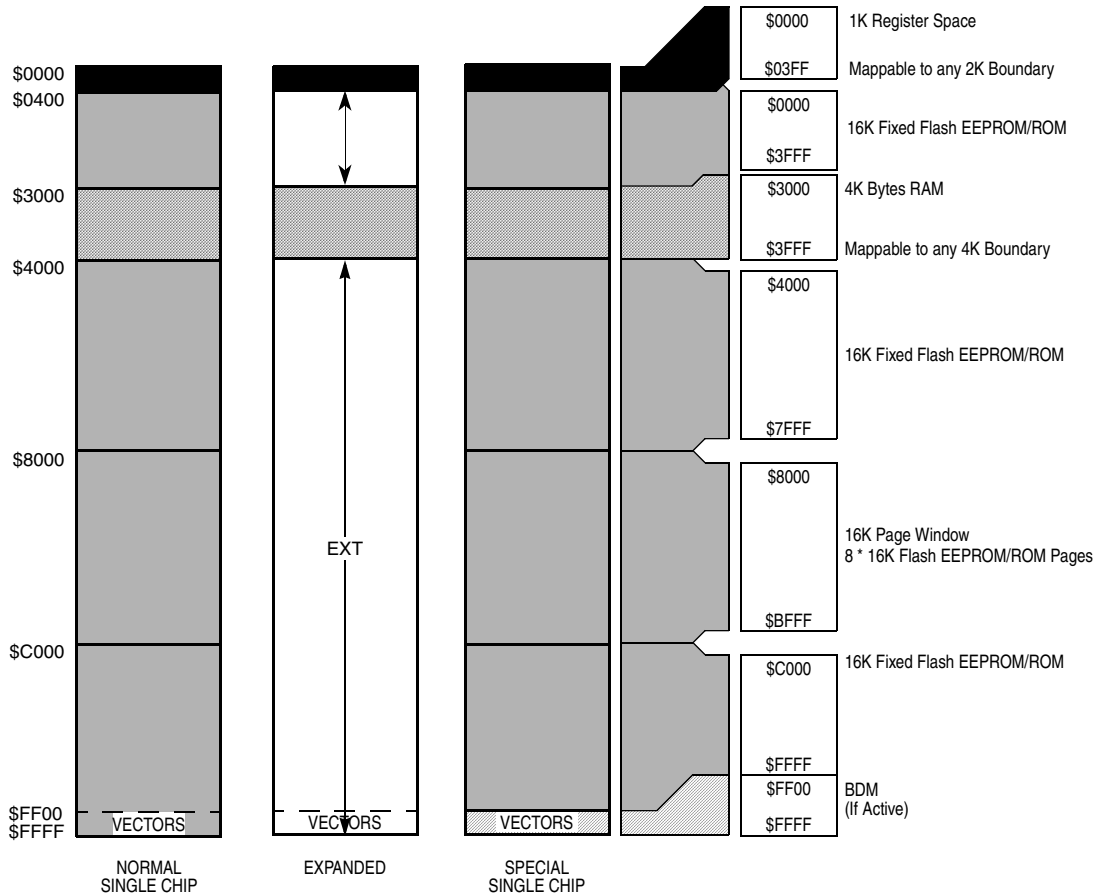
Port A = 1, B = 1, E = 2 + 2 input only, M = 6, P = 1, S = 2, T = 8, PAD = 8.  
3 inputs provide Interrupt capability (P= 1, IRQ, XIRQ)

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**Figure 1 Block Diagram**

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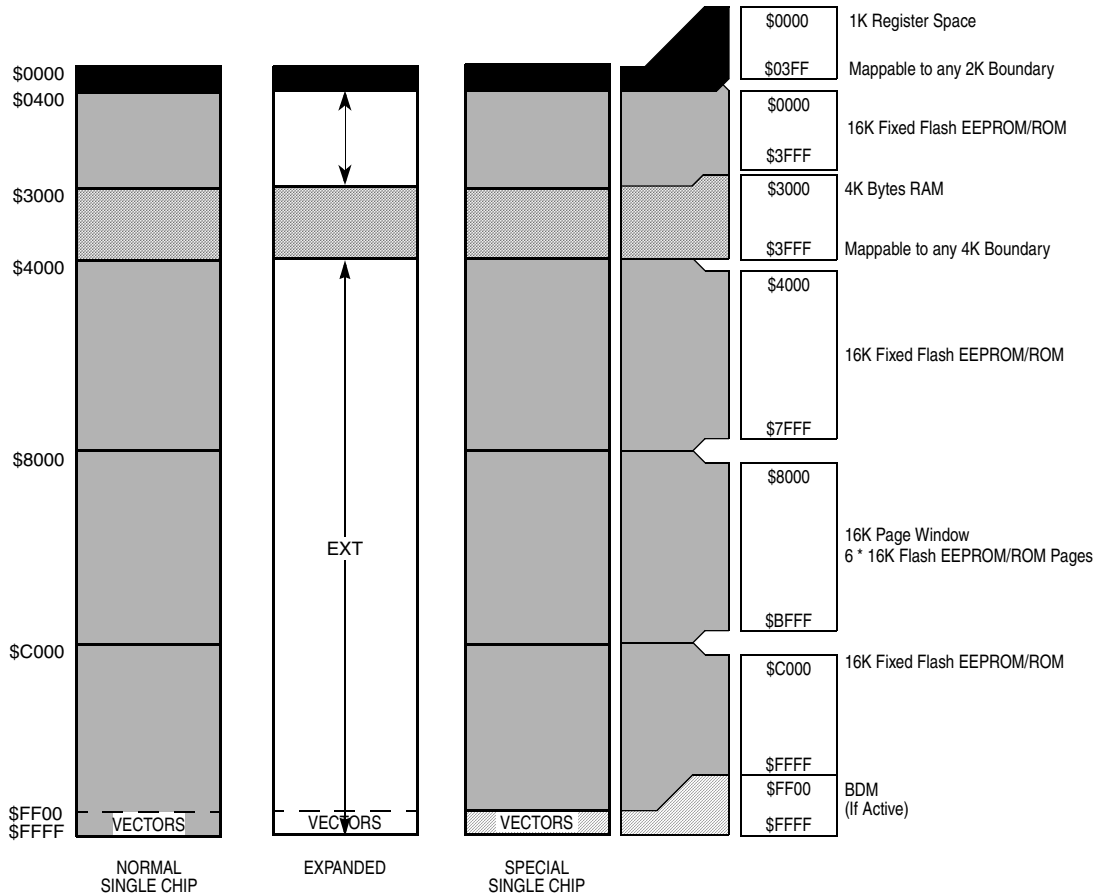
The figure shows a useful map, which is not the map out of reset. After reset the map is:

- \$0000 - \$03FF: Register Space
- \$0000 - \$0FFF: 4K RAM (only 3K visible \$0400 - \$0FFF)

Flash Erase Sector Size is 1024 Bytes

**Figure 2 MCxS12C128 User Configurable Memory Map**

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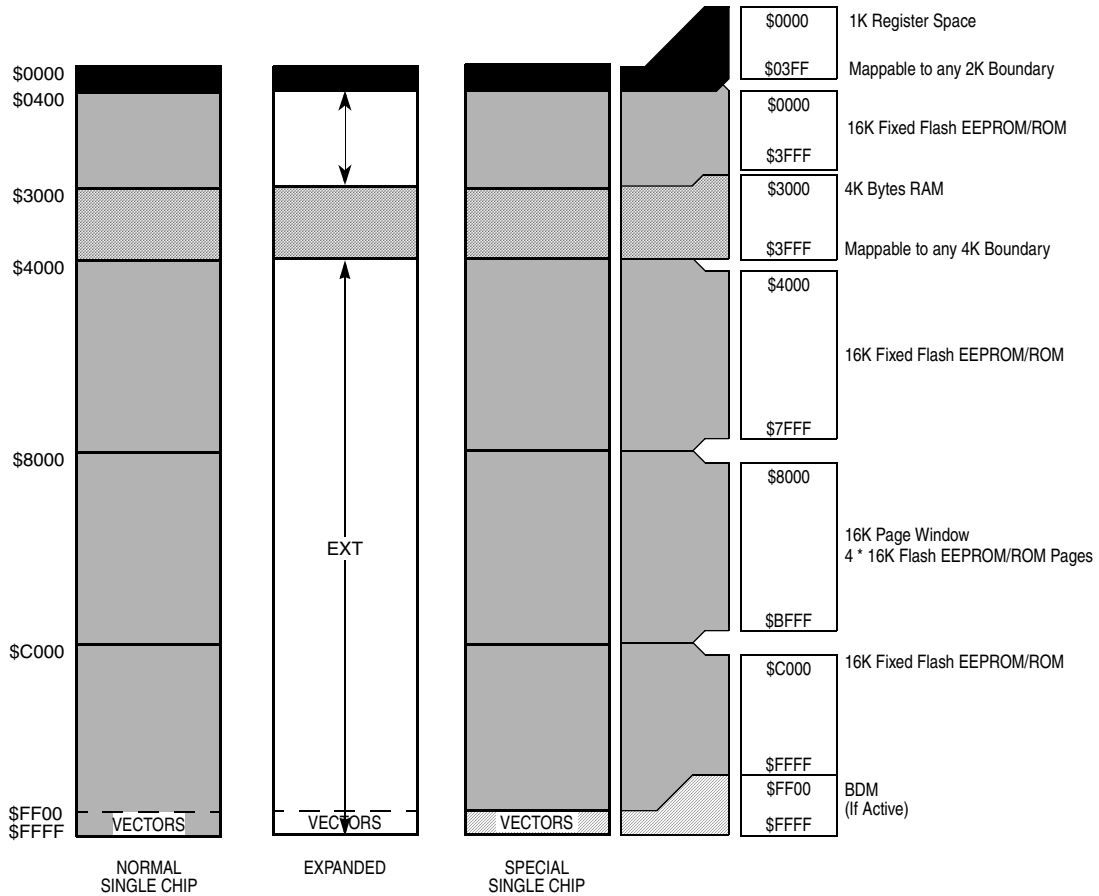
The figure shows a useful map, which is not the map out of reset. After reset the map is:

- \$0000 - \$03FF: Register Space
- \$0000 - \$0FFF: 4K RAM (only 3K visible \$0400 - \$0FFF)

Flash Erase Sector Size is 1024 Bytes

**Figure 3 MCxS12C96 User Configurable Memory Map**

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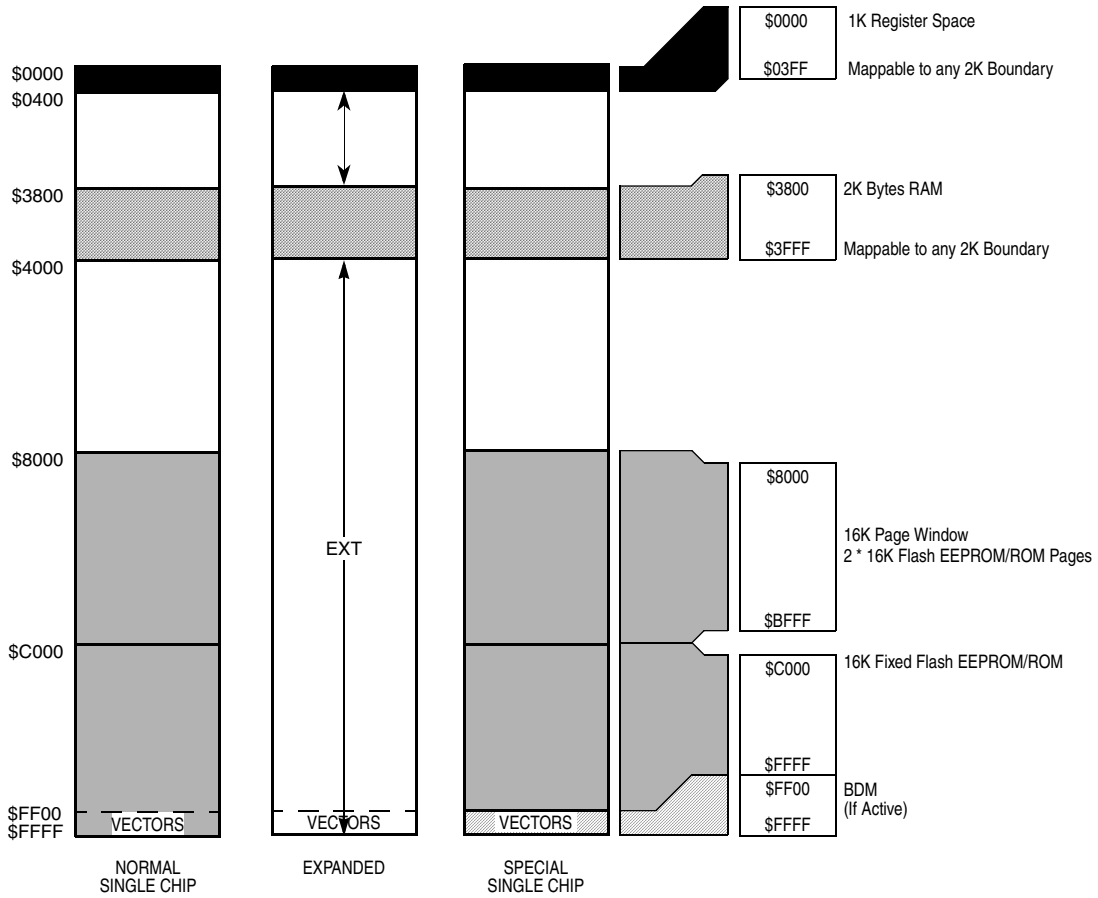
The figure shows a useful map, which is not the map out of reset. After reset the map is:

- \$0000 - \$03FF: Register Space
- \$0000 - \$0FFF: 4K RAM (only 3K visible \$0400 - \$0FFF)

Flash Erase Sector Size is 512 Bytes

**Figure 4 MCxS12C64 User Configurable Memory Map**

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The figure shows a useful map, which is not the map out of reset. After reset the map is:

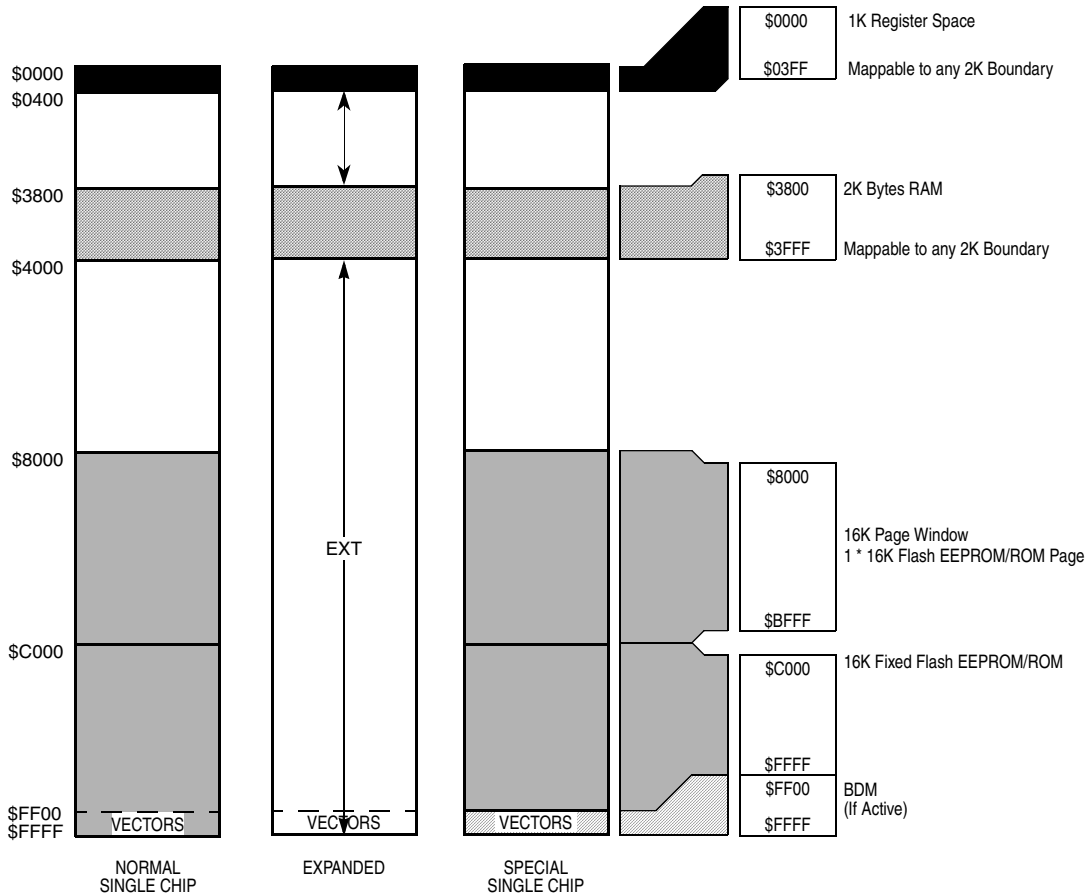
\$0000 - \$03FF: Register Space  
 \$0800 - \$0FFF: 2K RAM

Flash Erase Sector Size is 512 Bytes

**Figure 5 MCxS12C32 User Configurable Memory Map**



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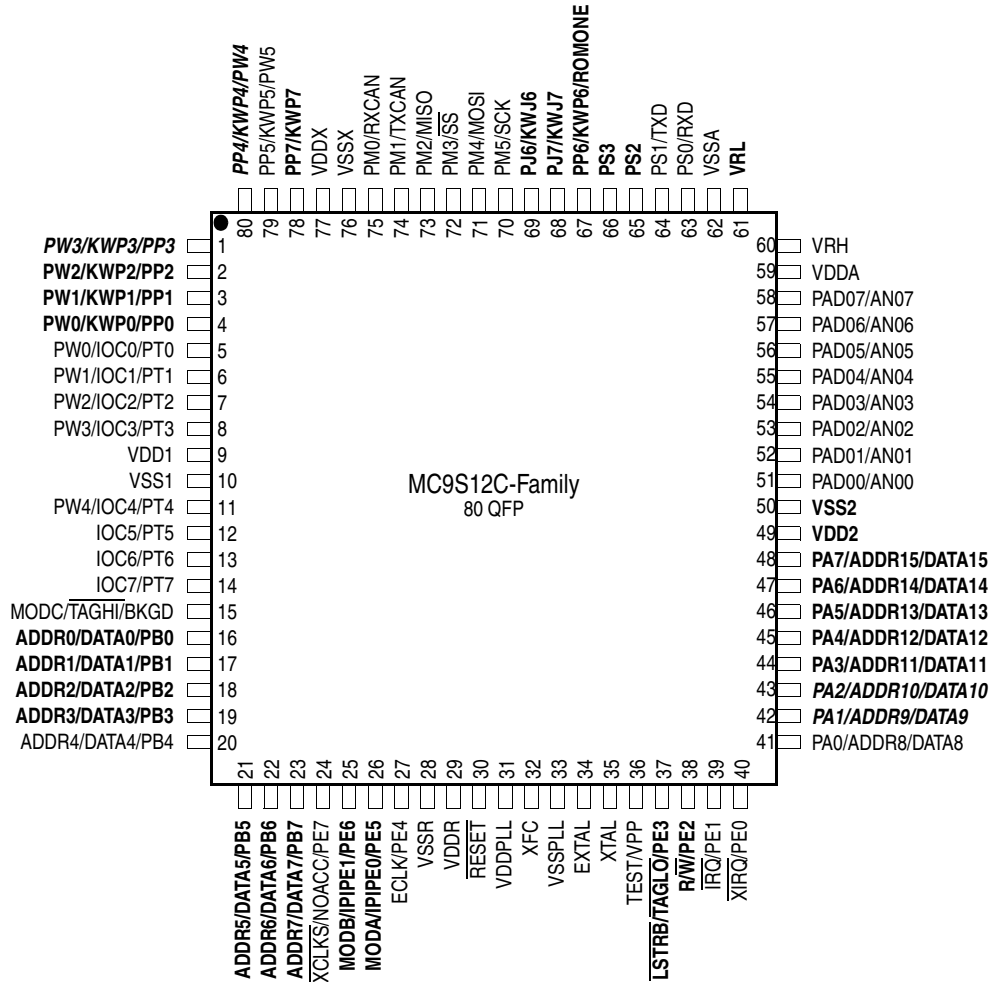
The figure shows a useful map, which is not the map out of reset. After reset the map is:

- \$0000 - \$03FF: Register Space
- \$0800 - \$0FFF: 2K RAM

Flash Erase Sector Size is 512 Bytes

**Figure 6 MCxS12C16 User Configurable Memory Map**

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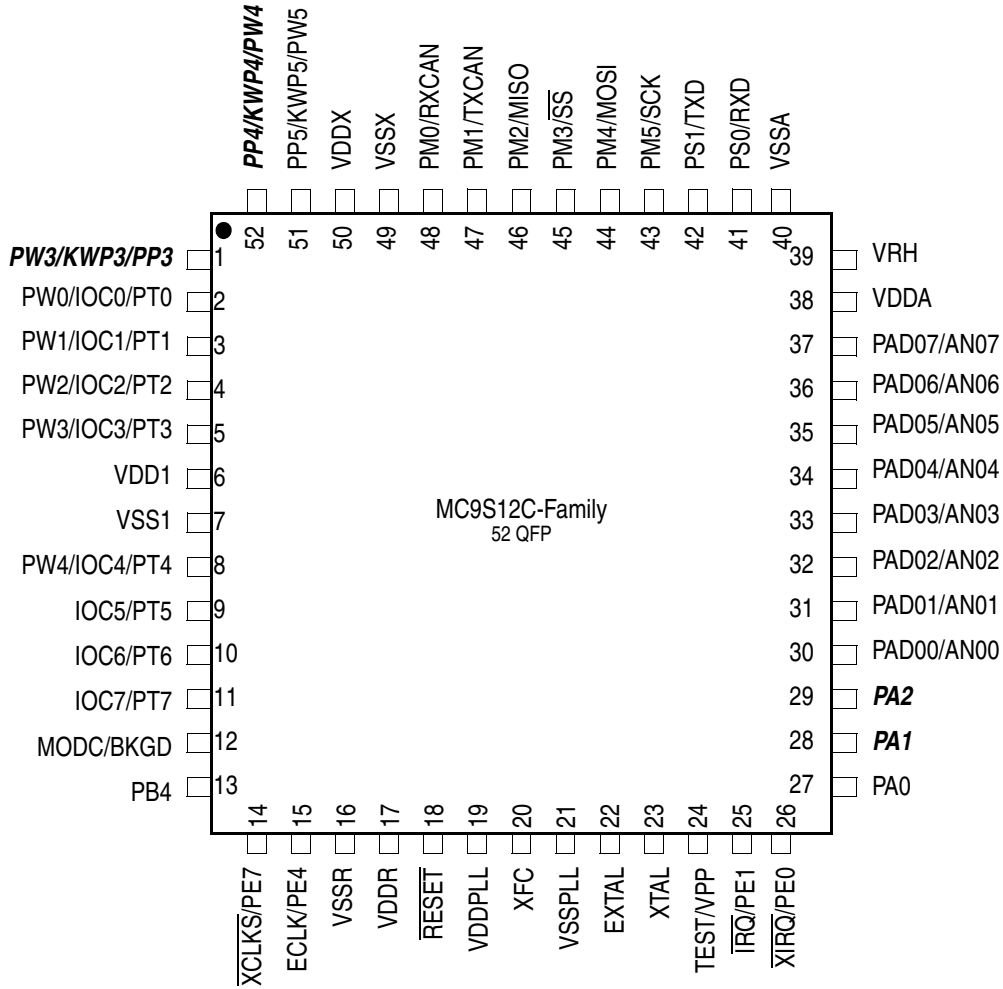


Signals shown in **Bold** are not available on the 52 or 48 Pin Package  
 Signals shown in **Bold Italic** are available in the 52, but not the 48 Pin Package

**Figure 7 Pin Assignments in 80 QFP for MC9S12C-Family**

!!! Pin-out is Subject to Change!!!

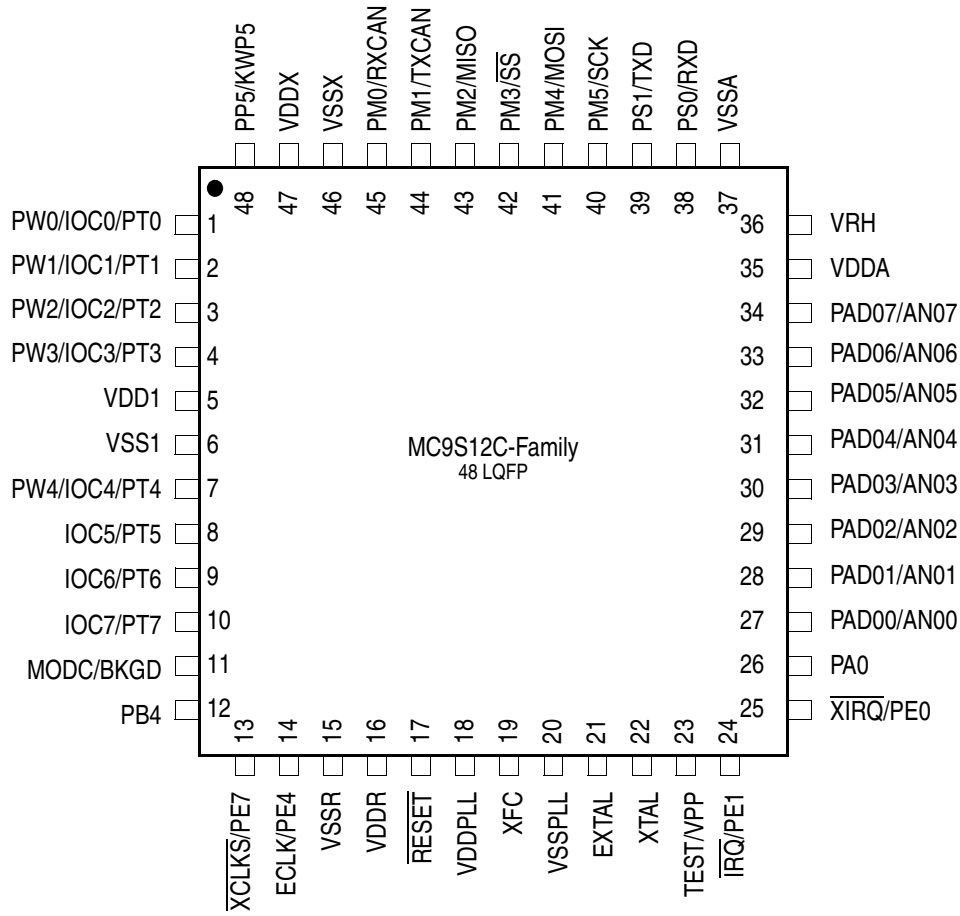
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\* Signals shown in **Bold** are not available on the 48 Pin Package

**Figure 8 Pin assignments 52 QFP for MC9S12C-Family**

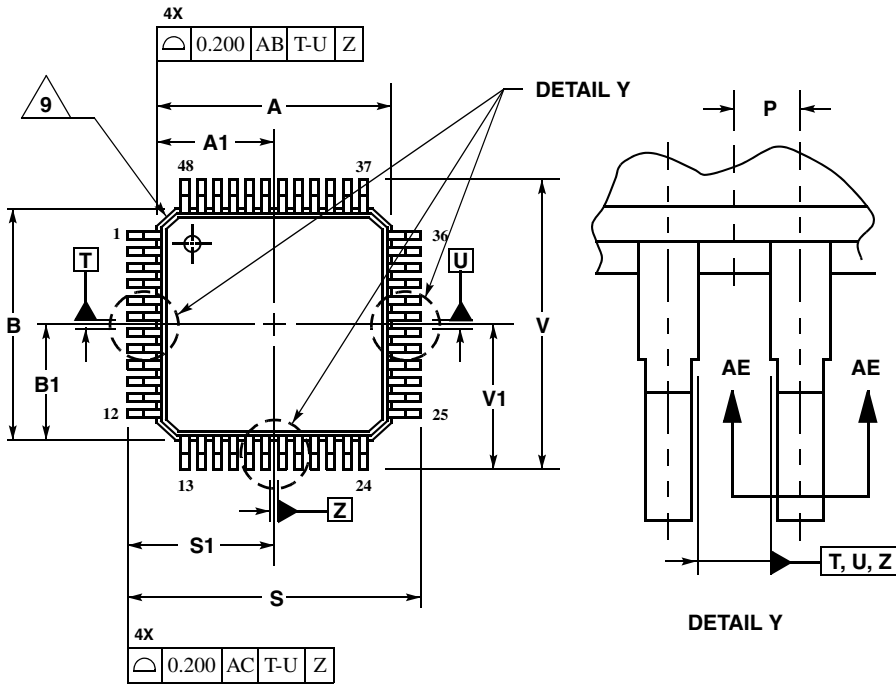
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**Figure 9 Pin Assignments in 48 LQFP for MC9S12C-Family**

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## Package mechanical information



**NOTES:**

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
- CONTROLLING DIMENSION: MILLIMETER.
- DATUM PLANE AB IS LOCATED AT BOTTOM OF LEAD AND IS COINCIDENT WITH THE LEAD WHERE THE LEAD EXITS THE PLASTIC BODY AT THE BOTTOM OF THE PARTING LINE.
- DATUMS T, U, AND Z TO BE DETERMINED AT DATUM PLANE AB.
- DIMENSIONS S AND V TO BE DETERMINED AT SEATING PLANE AC.
- DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS 0.250 PER SIDE. DIMENSIONS A AND B DO INCLUDE MOLD MISMATCH AND ARE DETERMINED AT DATUM PLANE AB.
- DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. DAMBAR PROTRUSION SHALL NOT CAUSE THE D DIMENSION TO EXCEED

DIM	MILLIMETERS	
	MIN	MAX
A	7.000	BSC
A1	3.500	BSC
B	7.000	BSC
B1	3.500	BSC
C	1.400	1.600
D	0.170	0.270
E	1.350	1.450
F	0.170	0.230
G	0.500	BSC
H	0.050	0.150
J	0.090	0.200
K	0.500	0.700
L	0°	7°
M	12°	REF
N	0.090	0.160
P	0.250	BSC
R	0.150	0.250
S	9.000	BSC
S1	4.500	BSC
V	9.000	BSC
V1	4.500	BSC
W	0.200	REF
AA	1.000	REF

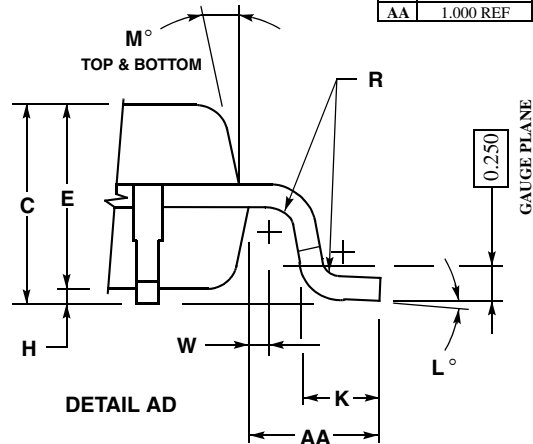
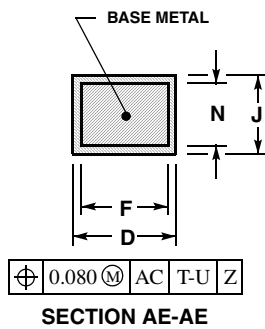
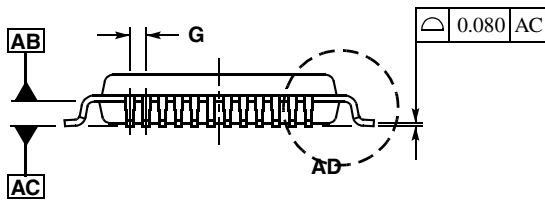
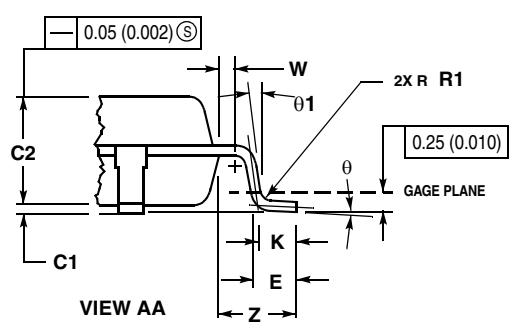
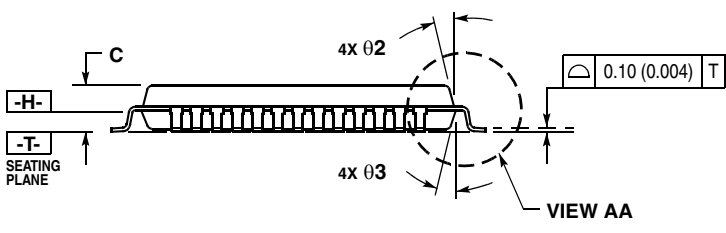
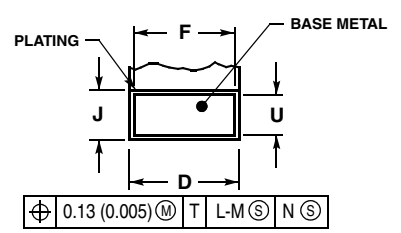
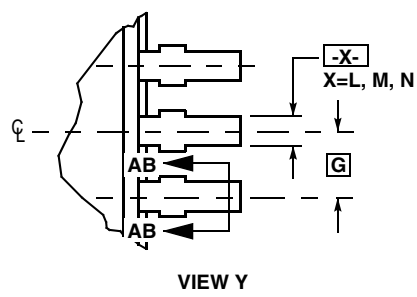
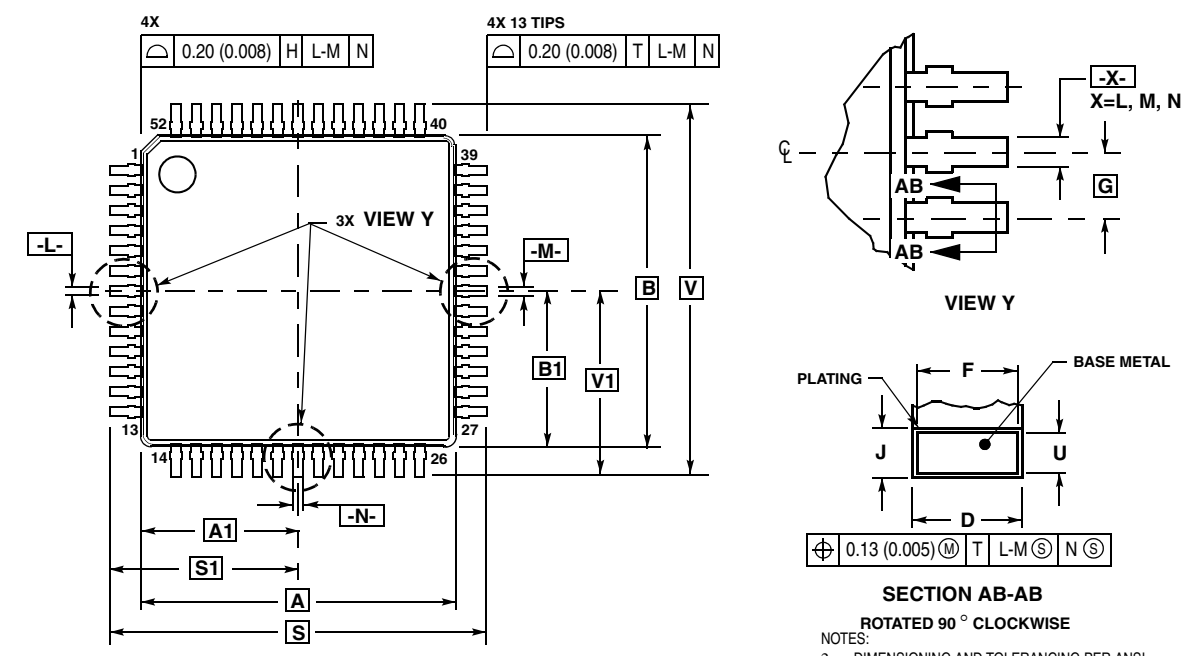


Figure 10 48-pin LQFP Mechanical Dimensions (case no.932-03 ISSUE F)

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DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.00 BSC		0.394 BSC	
A1	5.00 BSC		0.197 BSC	
B	10.00 BSC		0.394 BSC	
B1	5.00 BSC		0.197 BSC	
C	---	1.70	---	0.067
C1	0.05	0.20	0.002	0.008
C2	1.30	1.50	0.051	0.059
D	0.20	0.40	0.008	0.016
E	0.45	0.75	0.018	0.030
F	0.22	0.35	0.009	0.014
G	0.65 BSC		0.026 BSC	
J	0.07	0.20	0.003	0.008
K	0.50 REF		0.020 REF	
R1	0.08	0.20	0.003	0.008
S	12.00 BSC		0.472 BSC	
S1	6.00 BSC		0.236 BSC	
U	0.09	0.16	0.004	0.006
V	12.00 BSC		0.472 BSC	
V1	6.00 BSC		0.236 BSC	
W	0.20 REF		0.008 REF	
Z	1.00 REF		0.039 REF	
θ	0°	7°	0°	7°
01	0°	---	0°	---
02	12° REF		12° REF	
03	12° REF		12° REF	

Figure 11 52-pin LQFP Mechanical Dimensions (case no. 848D-03)

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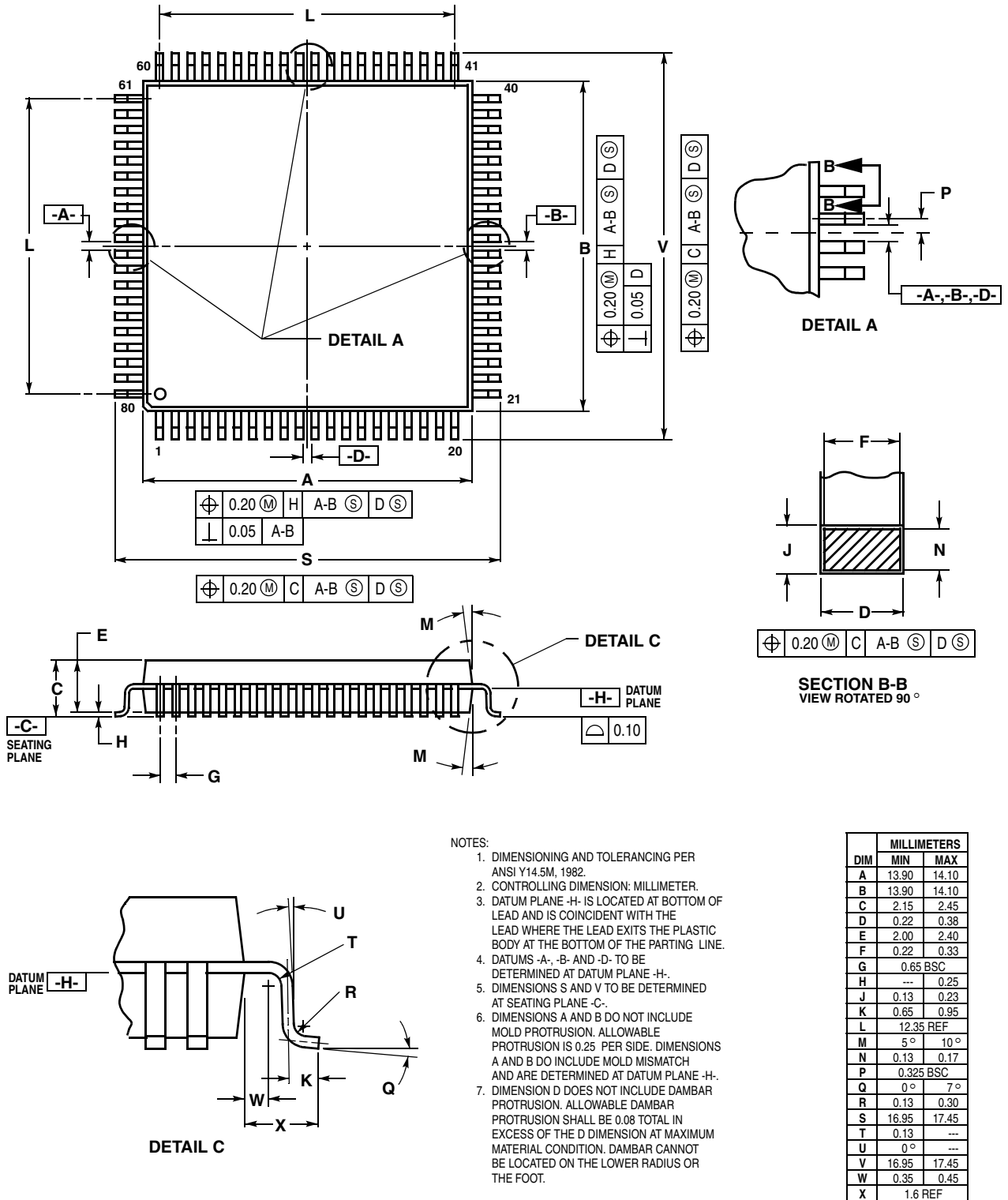



Figure 12 80-pin QFP Mechanical Dimensions (case no. 841B)

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